CHAPTER II

THE PROBLEMS AND MAJOR ISSUES

LAGOON-WIDE PROBLEMS

The Indian River Lagoon system is composed of three interconnected estuarine lagoons, the Mosquito Lagoon, Indian River Lagoon and the Banana River Lagoon (Figure 2). The lagoon system extends about 155 miles through six coastal counties from Ponce de Leon Inlet in Volusia County southward to Jupiter Inlet in Palm Beach County. The system is fairly shallow and narrow, with an average depth of 4 feet, and a width that varies from 0.2 to 5.5 miles. Circulation in these lagoons is generally sluggish except during large storms and in areas near inlets.

The lagoon system is a biogeographic transition zone, rich in habitats and species, with the highest species diversity of any estuary in North America (Gilmore, 1986). Approximately 2,200 species have been identified in the lagoon system (Barile, 1987), 35 of which are listed as threatened or endangered. Species diversity is generally higher near inlets and toward the south end of the lagoon system. It is lower near cities, where nutrient input, sedimentation, and turbidity are greater and where large areas of mangroves and seagrasses have been lost (Virnstein and Campbell, 1987). Much of the habitat loss has occurred as the result of shoreline development, navigational improvements, and marsh management practices.

Habitats and species diversity in the lagoon system are believed to be affected by the decline in water and sediment quality. There are two major types of impacts responsible for this decline: (1) pollution from point and nonpoint sources, and (2) alterations in the natural patterns of water circulation in the lagoons and freshwater flow into the lagoons. The intensification and expansion of human activities have altered hydrologic and hydrodynamic patterns; increased amounts of nutrients, suspended matter, and manufactured substances released to the lagoon; increased sedimentation rates in tributaries, navigational channels, and harbors; and promoted high levels of fecal coliform bacteria. The combined effects of these impacts are jeopardizing the aesthetic value and ecological health of the lagoon system.

Because of its physical characteristics, the Indian River Lagoon system is naturally susceptible to nutrient overenrichment and turbid conditions. Continued high nutrient and suspended matter loadings from anthropogenic sources threatens to transform the macrophyte-based system to a phytoplankton-based system, with damaging effects on estuarine resources. There are indications that nutrient overenrichment and excessive turbidity are already occurring in portions of the lagoon system. The most profound of these indications is the apparent loss of seagrass beds near urbanized watersheds.

Three FDER (now FDEP) reports -- *The Florida East Coast Basin Assessment* (Fitzgerald and Hadley, 1985), *The Indian River Lagoon Water Quality Survey* (Davis, 1986), and the *Florida Water Quality Assessment* 305(b) Technical Appendix (Hand and Paulic, 1992; Hand *et al.*, 1988 and 1990) -- present results of FDER water quality investigations in the lagoons. These reports noted the negative effects of urbanization, sewage, marinas, and drainage canals on tributary and lagoon water

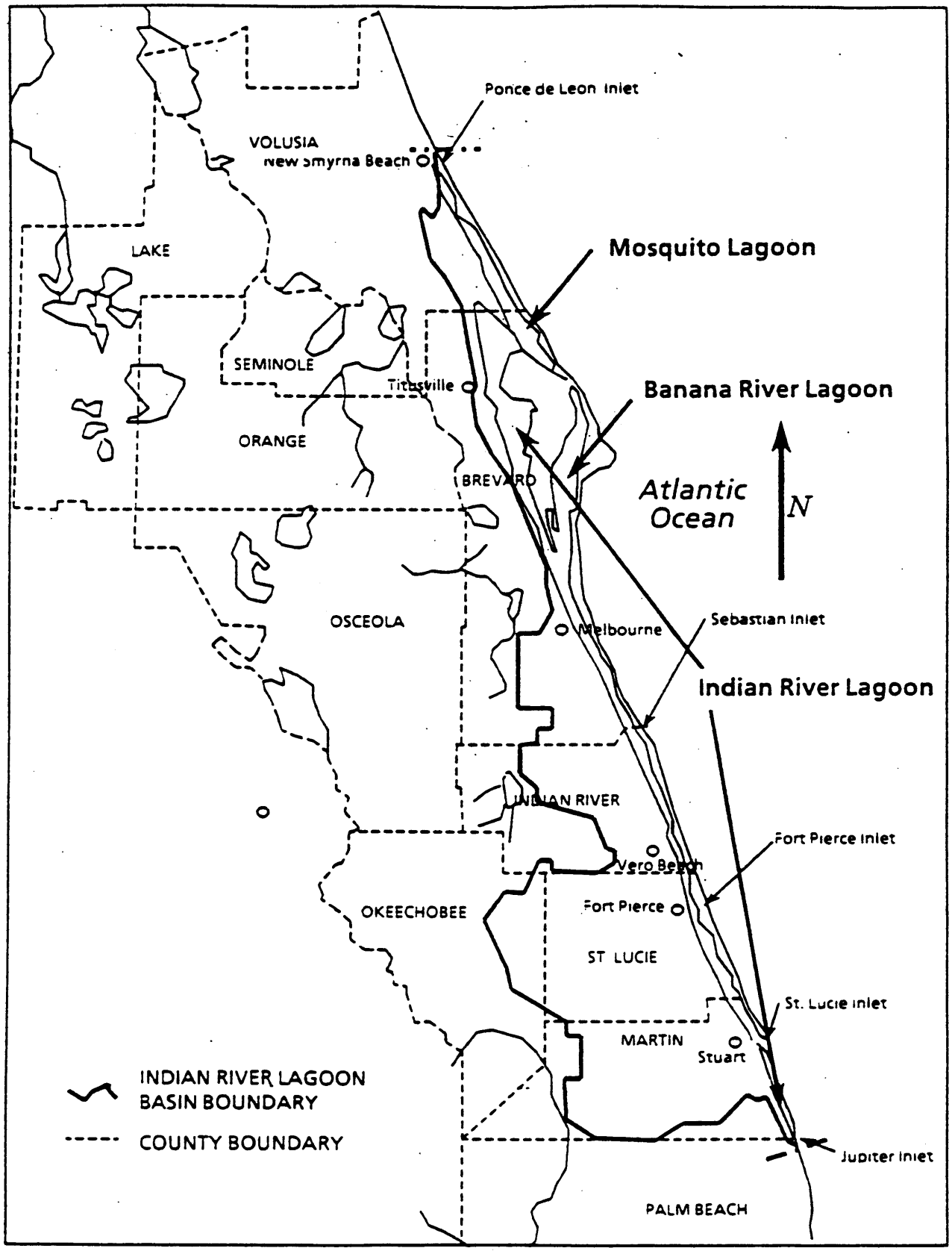

FIGURE 2. Major Features of the Indian River Lagoon Study Area.

quality as indicated by high levels of nutrients, fecal coliform bacteria, chlorophyll a, turbidity, and low dissolved oxygen.

Other publications have also documented or indicated that certain conditions and uses of the lagoon system are ecologically disruptive:

- Intrabasin and interbasin drainage systems discharge large volumes of water into the Indian River Lagoon. Nine of the major canals have a combined peak discharge of approximately 10 billion gallons per day based on the maximum average recorded discharge for a 24-hour period (Steward and Van Arman, 1987). Direct runoff to the lagoon from waterfront residential and commercial property also contributes to the pollutant loadings. Sustained high volume storm water discharges can directly impact estuarine-dependent organisms and their habitats and can produce biologically undesirable fluctuations of salinity, as well as excessive sedimentation. Alternatively, these same drainage systems, with their associated control structures, can effectively curtail freshwater flows to the lagoon during dry seasons. Through interruption of base flows, this can elevate salinities, impacting habitats and their indigenous organisms dependent on brackish or freshwater areas for at least part of their life cycles (Windsor and Steward, 1987).

- Domestic and industrial wastewater treatment plants discharge fresh water and pollutants, in potentially harmful quantities, into the Indian River Lagoon (Hand *et al.*, 1986).

- The operation of marinas and boatyards contributes toxic or deleterious substances (e.g., heavy metals, hydrocarbons and raw sewage) to the Indian River Lagoon (Indian River Lagoon Field Committee, 1986).

- Circulation and flushing are excessively limited in some areas of the lagoon (Evink, 1980).

- A fine-grained sediment has been observed in several lagoon bottom areas adjacent to developed drainage basins. This "muck" sediment is largely composed of organic material and eroded upland soils, the amounts of which are apparently being generated at an accelerated rate commensurate with high rates of algal productivity and land use intensification without effective soil erosion programs. Muck is a repository for a variety of pollutants and may be a significant source of internal pollutant loading to lagoon waters. Furthermore, this sediment can easily be resuspended by boat traffic and dredge and fill operations, thereby, contributing to the lagoon's turbidity problem (Trefry *et al.*, 1987).

- Emergent wetlands and seagrass beds are critical components of the Indian River Lagoon and play important roles in biological productivity and species diversity. Since the 1950s, the Indian River Lagoon has lost, through destruction and/or impoundment, over 75 percent of its emergent wetland vegetation (Indian River Lagoon Field Committee, 1986). For three areas, near Ponce de Leon Inlet, Sebastian Inlet and north of Ft. Pierce, Haddad (1985) estimated seagrass losses of 100 percent, 38 percent, and 25 percent, respectively, since the 1950s. There is a concern that existing seagrass beds are threatened by adverse water quality conditions (e.g., nutrient overload and high turbidities) (Windsor and Steward, 1987).

Details on the description of the Indian River Lagoon system and its environmental status can be found in the *Indian River Lagoon Joint Reconnaissance Report* (Steward and VanArman, 1987). The reconnaissance report is a comprehensive technical reference and treatise on the natural and anthropogenic processes that define the lagoon system. Included in the report are inventories and atlases of technical information; summaries of scientific studies; interpretations of collated, multi-agency data; syntheses of multidisciplinary research findings; and recommendations that consider future research, monitoring, and management needs. As a complementary reference to the reconnaissance report, an extensive Indian River Lagoon bibliography is also available (*Bibliography of the Indian River Lagoon Scientific Information System*, edition 1; 1989; Marine Resources Council, Florida Institute of Technology, SJRWMD, and SFWMD).

Information from the reconnaissance report and other sources on the physical features, historical and current uses of the lagoons' resources, the basin's land use and population, and environmental conditions have been condensed and is found in Appendix B. Additionally, an inventory of completed and ongoing studies that were initiated since July 1990 is provided in Appendix C. Similar inventories of studies that were initiated prior to July 1989 are found in the *Interim SWIM Plan for the Indian River Lagoon* (August 1988) and the *Indian River Lagoon SWIM Plan* (September 1989).

SPECIFIC PROBLEM AREAS

Several recent publications (Table 2) were reviewed to determine specific areas in the lagoon system reported to have some or all of the problems cited above. These publications are in general concurrence regarding the location of problem areas.These are the areas targeted for various research, restoration and/or conservation projects within this SWIM plan.

TABLE 2. Major Publications Reviewed for Identification of Problem Areas.

Indian River Lagoon Joint Reconnaissance Report (Steward and VanArman, 1987)

Indian River Lagoon Level II Report - First Year (1986/87) (Steward and Clapp, 1989)

The Florida East Coast Basin Assessment (Fitzgerald and Hadley, 1985)

The Indian River Lagoon Water Quality Survey (Davis, 1986)

Florida Water Quality Assessment 305(b) Technical Appendix and Main Report (Hand and Paulic, 1992; Hand *et al.*, 1988 and 1990)

Holocene Sedimentation in a Low energy Microtidal Estuary St. Lucie River, Florida (Schrader, 1984)

Origin, Composition and Fate of Organic-Rich Sediments in Coastal Estuaries: Project Muck (Trefry et al., 1987)

Comprehensive Shellfish Growing Area Surveys (FDNR,Shellfish Environmental Assessment Section)

Local Government Comprehensive Plans for Volusia, Brevard, Indian River St. Lucie, Okeechobee, Martin, and Palm Beach counties

In the 1989 IRL SWIM Plan the following twelve problem areas were identified as the focus areas for many SWIM efforts within the Indian River Lagoon:

- Mosquito Lagoon
- Titusville Vicinity
- Cocoa/Rockledge and South Banana River Lagoon
- Eau Gallie River Watershed
- Crane Creek Watershed
- Turkey Creek Watershed
- Sebastian River Watershed
- Lagoon Segment Between Melbourne and Sebastian
- Vero Beach Vicinity
- Moores Creek/Virginia Avenue Canal (Ft Pierce)
- Five and Ten Mile Creeks within the St. Lucie River Watershed, and
- Manatee Pocket within the St. Lucie River watershed

These areas (Figure 3) were selected because of their poor water quality conditions relative to the Indian River Lagoon Basin as a whole. According to the FDEP *Florida Water Quality Assessment (305[b] Technical Appendix (Hand and Paulic, 1992)*, a few of the problem areas do not meet their Class III use designation (Titusville vicinity, Cocoa/Rockledge and South Banana River Lagoon, including Sykes Creek, Crane Creek, and the North and South prongs of the Sebastian River. Other areas designated as Class II (shellfish harvesting waters) have been reclassified from approved to conditionally approved for shellfish harvesting because bacteriological conditions do not meet state health standards (i.e., lagoon segment between Melbourne and Sebastian, and the Mosquito Lagoon). The remaining areas partially meet their Class III use designations but are showing indications of decline (i.e., Eau Gallie River, Turkey Creek, Vero Beach vicinity, Moores Creek, St. Lucie estuary, and Manatee Pocket).

In this update, the remaining subbasins (C-23, C-24, C-44) of the St.Lucie River have been added to those areas previously identified above (Five- and Ten-Mile creeks) within the North Fork subbasin. The Manatee Pocket, a component of the St. Lucie Estuary, is also incorporated within the new Appendix I entitled "St. Lucie River Watershed Plan." This change is discussed in the revised priority ranking of problem areas presented in the Water and Sediment Quality Chapter.

Further detail on water quality conditions in each of the problem areas is found in Appendix B.

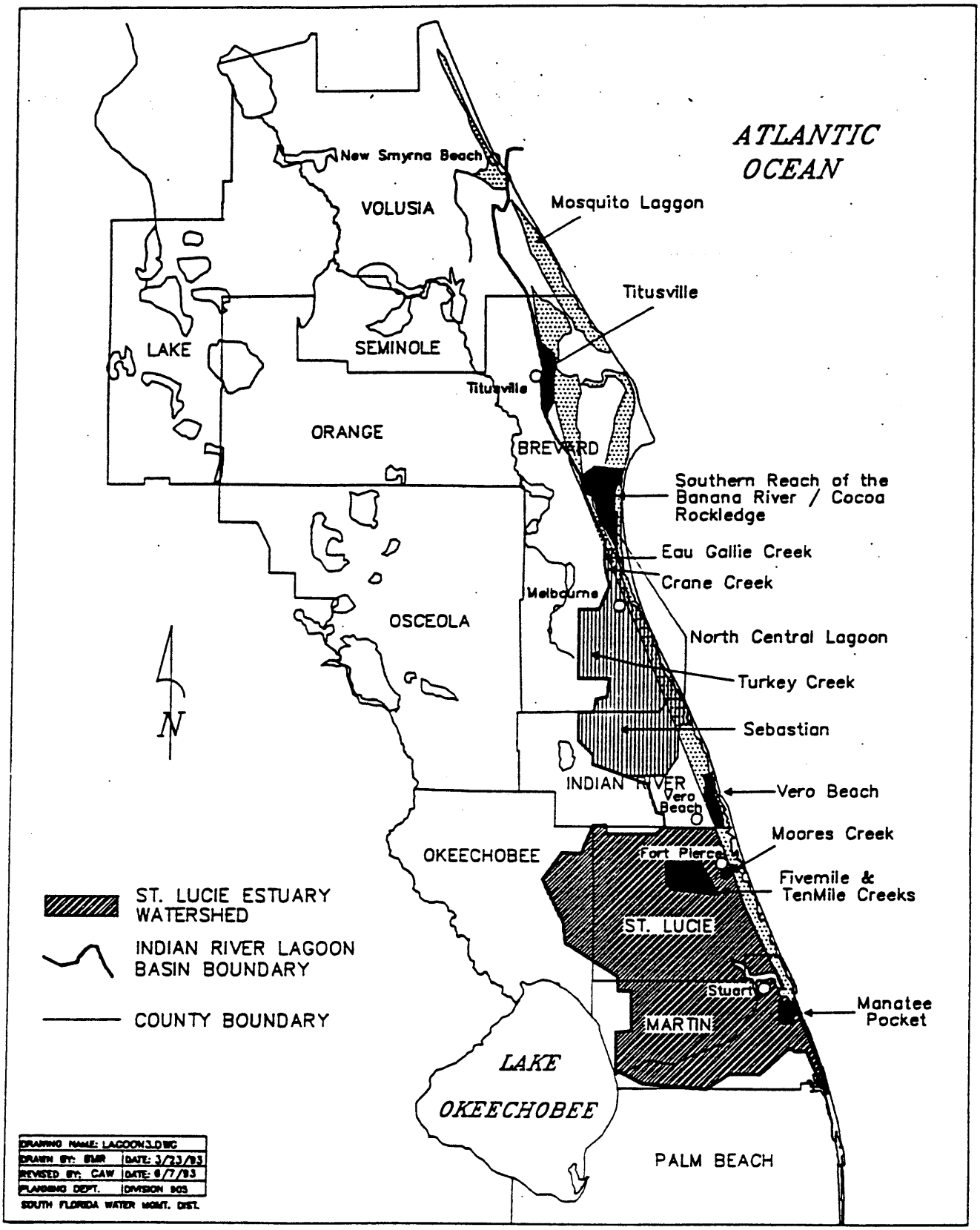

FIGURE 3. SWIM Target Areas within the Indian River Lagoon.

THE MAJOR ISSUES WITHIN THE INDIAN RIVER LAGOON

The process of identifying the major issues within the Indian River Lagoon was initiated in 1981 when scientists and resource managers gathered for the "Future of the Indian River System" (FIRST) Symposium to share not only current research findings but a concern for the problems of the lagoon system. Over the next several years, a series of symposia, conferences, and workshops continued to define the issues and provide general recommendations for their management (e.g., American Assembly meetings of 1985, 1986, and 1989 sponsored by the Marine Resources Council of the Florida Institute of Technology; and the 1985-1987 Indian River Lagoon Field Committee under the direction of the Governor's Interagency Management Committee). Following the passage of the SWIM legislation, the SJRWMD and SFWMD evaluated the scientific documentation (summarized and referenced in the preceding sections on environmental problems), various committees' reports, and other agencies' plans or reports in order to identify the major issues that can be addressed by this SWIM Plan update.

Many of the environmental problems that have been identified may be addressed through the SWIM planning effort. However, due to limitations in SWIM funding and on the types of projects that can be funded, there are some environmental issues that must necessarily receive a lower priority and some issues that may be better dealt with by other funding mechanisms or programs.

The Indian River Lagoon issues addressed in this plan are divided into three categories: (1) water and sediment quality, (2) natural habitats, and (3) interagency management of the lagoon system's resources. The issues are briefly discussed below.

Water and Sediment Quality Issues

Extreme, undesirable salinity fluctuations can occur as a consequence of modified freshwater inflows. Storm water volumes from urban and agricultural areas are generally greater than those associated with predevelopment conditions. Intra- and interbasin drainage networks may also divert additional water (ground water, storm water, and irrigation water) to the lagoon system. Significant reductions in freshwater discharges to the lagoon may occur during extended dry periods because of artificially lowered water tables, and loss of natural surface storage areas (wetlands), as well as the reduction of flows by coastal structures in an attempt to conserve water for agricultural and urban uses. Changes in volume, distribution, and timing of inflows can appreciably affect salinity gradients, nutrient and suspended matter loadings, sedimentation rates, and biotic communities distribution.

Suspended matter loadings and sedimentation rates have increased in some urban sub-basins over the last 40 years. The composition of this rapidly accreted sediment is largely inorganic upland soil (sands, clays and silts) eroded by wind and storm water, a process exacerbated by ineffective soil retention practices. These muck sediments can be readily resuspended and create turbidity problems, blanket productive benthic habitats, attenuate light levels required for seagrass growth, and entrap (and potentially release) toxic substances and nutrients to overlying waters and organisms. Activities that contribute to this problem include land clearing, construction, agriculture, canal maintenance, and dredge and fill operations.

Excessive nutrient loadings may largely originate from external sources (i.e., tributaries and canals draining agricultural, residential, and commercial land uses, wastewater treatment plants, and ground water). In certain areas, internal sources, primarily organic sediments, may also contribute excessive levels of nutrients to overlying waters.

Releases of manufactured organic substances and metal-based materials may pose a hazard to lagoon biota and to the human consumer of shellfish and finfish. Sources for such releases can be various industrial, construction, marina and agricultural activities.

Pathogenic bacteria are a concern, especially in shellfish harvesting areas. Clams and oysters can ingest and concentrate pathogens (and a variety of other pollutants) from surrounding waters, thus posing a threat to consumers. Both natural and anthropogenic sources (e.g., septic tank leachate, domestic wastewater effluent, and pasturelands) should be identified and controlled to the extent possible.

Habitat Issues

Since the 1950s, the Indian River Lagoon system has lost, through destruction and impoundment, over 75 percent of its emergent wetlands. While many impoundments of the high salt marsh and mangrove communities have furnished needed mosquito control, they have also isolated the vast majority of the marsh and mangrove community from the lagoon.

Seagrass beds are another critical component of the Indian River Lagoon and play an important role in biological productivity and diversity. Documented losses range from 100 percent to 25 percent at specific study sites within the lagoon. Some seagrass beds appear to be threatened by adverse water quality conditions (e.g., turbidity and nutrient overload).

Interagency Management Issues

Proper protection and renovation of the lagoon resources requires coordination among the federal, state, regional, and local agencies that have regulatory or management authority in the region (Indian River Lagoon Field Committee, 1986). The SWIM Act partially fulfills this requirement by directing the SJRWMD and the SFWMD, with the participation of other governmental agencies, in the development and implementation of an interagency management plan. Additional efforts to coordinate multiple agency programs are provided by the National Estuary Program. This program was instituted following federal designation of the Indian River Lagoon as an estuary of national significance. Some of the specific problems that must be addressed to achieve adequate management of the lagoon system are:

- Some environmental protection rules and rule criteria have been perceived as being inadequate (Indian River Lagoon Field Committee, 1987).

- Inadequate enforcement of rules and permit compliance is common among all the state's regulatory agencies (Indian River Lagoon Field Committee, 1987; Environmental Efficiency Study Commission, 1988). Three conditions contribute to this problem: (1) the large number of violations, (2) the nature of the violations, and (3) lack of sufficient staff.

- There is a deficit of awareness and technical knowledge for informed decision making. Resource managers and the area's residents need to be better informed of the lagoon's specific problems and possible solutions. This is necessary in order to achieve success for both SWIM and other environmental protection programs.

The SWIM Goals, Objectives and Strategies to address these issues are presented in the next chapter.

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